Small Business Innovation Research/Small Business Tech Transfer

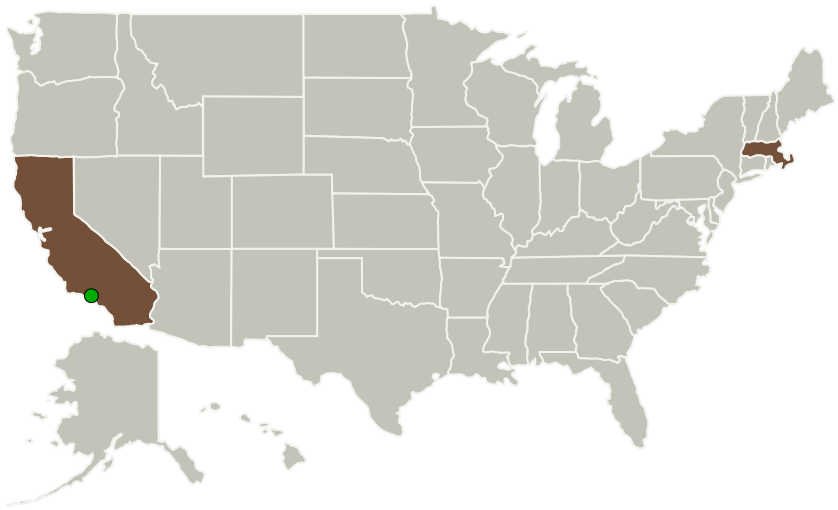
Real-Time Monitor of Clumped CO2 Isotope in Ambient Air, Phase I

Completed Technology Project (2016 - 2016)

Project Introduction

Greenhouse gas (GHG) emissions are the primary drivers of global climate change and hence there is a crucial need to quantify their sources and sinks. A powerful technique to help constrain source and sink strengths in GHG exchange processes is the analysis of the relative proportions of isotopic variants of GHG's. In this proposal, we focus on the most important GHG: carbon dioxide. The standard isotopes of carbon dioxide (13C-CO2 and 18O-CO2) are already being measured on a global scale (for example by NOAA and INSTAAR within the Global Greenhouse Gas Reference Network). We propose to demonstrate and commercialize new isotopic measurement capabilities for more exotic isotopes of carbon dioxide that are difficult to measure with existing techniques. Specifically, we propose using Tunable Infrared Laser Direct Absorption Spectroscopy (TILDAS) to measure the primary clumped isotope of CO2 (Δ13C18O16O) and to simultaneously measure the mass independent 17O content (Δ17O). The proposed instrument will directly measure atmospheric samples with no need for chemical separation and will report isotopic ratios with 0.02 per mil repeatability and with time resolution of 2 to 3 minutes. The instrument will be sufficiently compact to be field or flight deployable thus providing the possibility of continuous high accuracy measurements of Δ13C18O16O and Δ17O rather than occasional flask samples.

Primary U.S. Work Locations and Key Partners



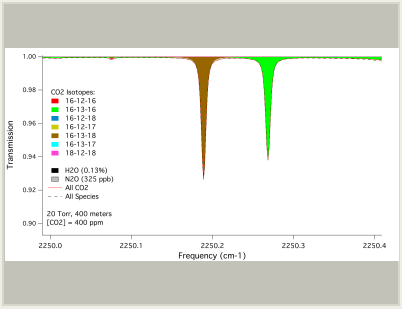


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Table of Contents

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Organizations Performing Work	Role	Type	Location
Aerodyne Research, Inc	Lead Organization	Industry	Billerica, Massachusetts
Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations	
California	Massachusetts

Project Transitions

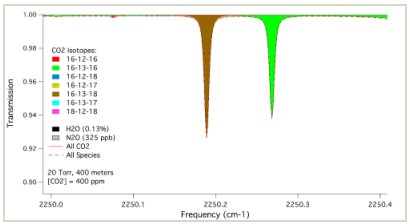
June 2016: Project Start

December 2016: Closed out

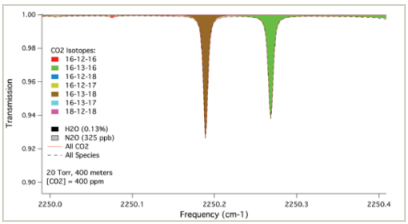
Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/139663)*

Images



Briefing Chart Image
Real-time monitor of clumped CO2 isotope in ambient air, Phase I *(https://techport.nasa.gov/image/133230)*



Final Summary Chart Image
Real-time monitor of clumped CO2 isotope in ambient air, Phase I Project Image *(https://techport.nasa.gov/image/128523)*

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Aerodyne Research, Inc

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

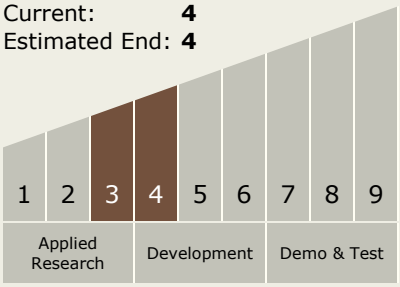
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
David D Nelson

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



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Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.5 Lasers

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System